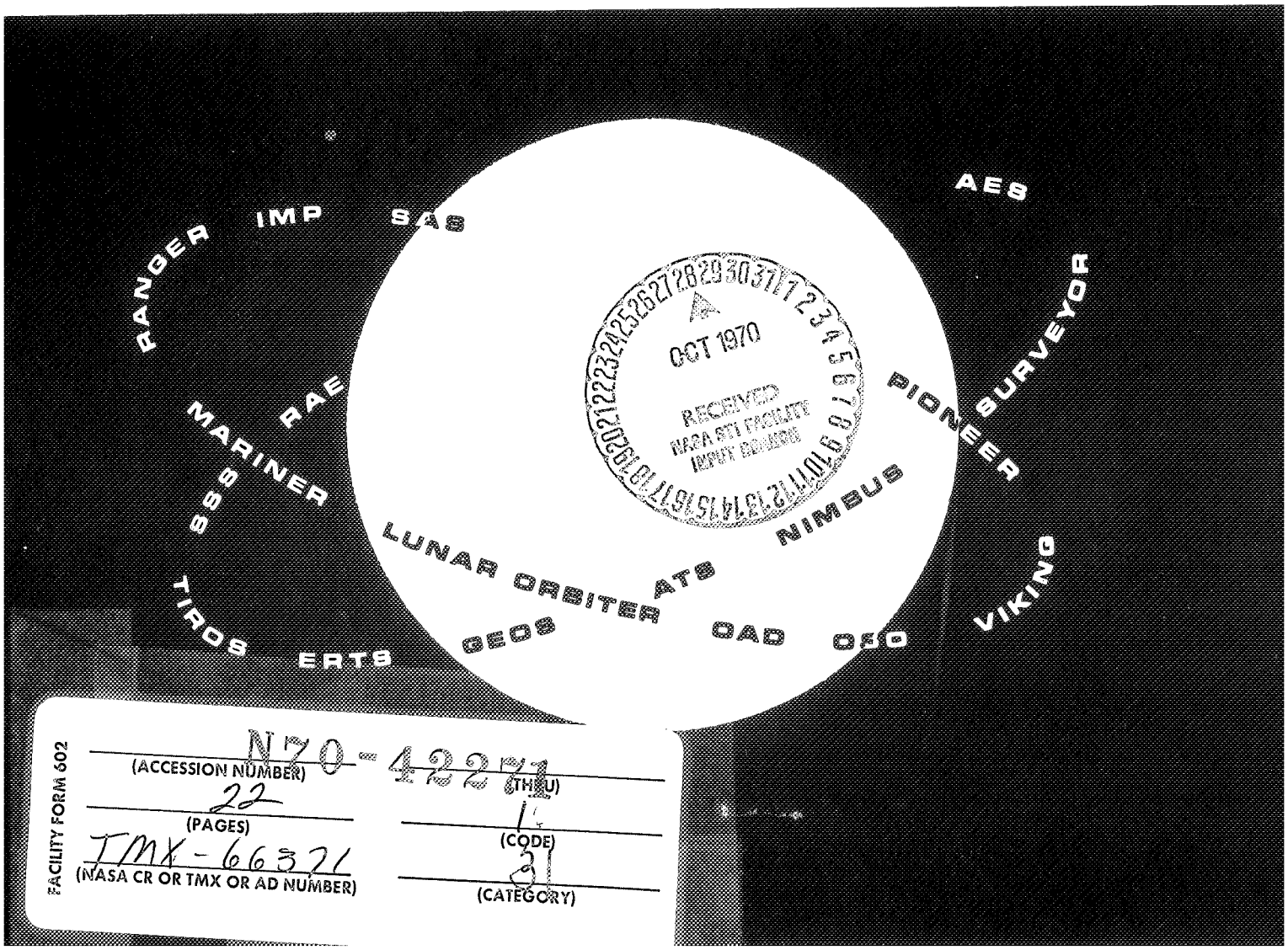
OCTOBER 1970

Space Science and Applications



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(Editors: This fact sheet contains information on NASA's space science and applications program. It is suggested that it be retained in your files.)

The Office of Space Science and Applications (OSSA) of the National Aeronautics and Space Administration is responsible for almost all unmanned launches concerned with scientific investigations as well as those having a direct benefit to mankind.

OSSA's Earth-orbiting spacecraft have investigated the near-Earth environment discovering new scientific facts, such as the Van Allen radiation belts, energetic particle and solar activity, the shape of the Earth and meteorological phenomena not possible to obtain in any other way. Scientific spacecraft have looked, safely above the atmospheric curtain, far into space to receive more information on the formation of planets, stars and galaxies.

Automated spacecraft have observed Mars and Venus, mapped the Moon, observed the Sun from various points in the solar system and future missions will give us even more information on previously visited planets as well as Mercury, Jupiter, Saturn, Uranus and Neptune.

Two operational systems are now in daily use because of research and development work by NASA -- an operational meteorological satellite system and a commercial communications satellite system. Another operational system to supply us with valuable information on Earth resources including the extent of atmosphere and water pollution may well be a reality in the next few years.

The Space Applications program covers research, development, and flight testing of experiments, subsystems, and spacecraft in the areas of applications technology, communications, Earth resources, geodesy,meteorology, and navigation and includes development of operational systems for user agencies.

The objectives of the Space Applications program are to:

1. Conduct research and technical development oriented toward the application of space techniques for the benefit of mankind;

2. Expand our knowledge of the atmosphere and the effects of space phenomena;

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3. Develop and test procedures, instruments, subsystems, spacecraft, and interpretive techniques for the various applications;

4. Fulfill NASA's responsibilities under the Communications Satellite Act of 1962;

5. Develop and implement for the Environmental Science Services Administration (ESSA), Department of Commerce, the operational meteorological satellite system;

6. Cooperate with the user government agencies such as the Departments of Agriculture, Commerce, Interior, and Navy to achieve the practical benefits to mankind in Earth resources; and

7. Cooperate to the extent possible with foreign countries in the advancement of space applications.

Program:	Applications Technology Satellite (ATS)
Description:	Synchronous (stationary) orbit spacecraft to investigate and flight test technology common to a number of satellite applications. ATS 1 and 3 successfully accomplished experiments including black and white and color cloud cover pictures, very high frequency communications experiments with aircraft, transmission of TV, and a number of environmental measurement experiments. ATS 4 and 5 were to test gravity-gradient stabilization (spacecraft always pointed toward Earth due to gravitational attraction on long booms). ATS F and G are designed to develop technology for large (30-foot) erectable antenna in space and accurate (0.1^{0}) pointing accuracy in order to provide good TV signal to small, inexpensive ground receiver. Also to include experiments in air traffic control and laser communication. Launch from ETR; 1-3 by Atlas/Agena; 4 and 5 by Atlas/Centaur, and F and G, Titan III-C.
Schedule:	Two flights, ATS-F in 1973 and G in 1975. Five previous flights, one in December 1966 successful; ATS II in April 1967, vehicle failure; ATS 3 November 1967, success; ATS 4 August 1968, vehicle failures; and ATS 5 August 1969, spacecraft failure.
Program Officials:	J. R. Burke, Program Manager, and D. Fordyce, Project Manager (GSFC) (1-5); H. Gerwin, Project Manager (F and G).
Funding:	$173 million obligated through June 1970; runout costs estimated at $325 to $360 million.
Contractors:	For ATS 1 through 5, Hughes Aircraft Co. For ATS F & G, Fairchild Hiller Corp.

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Program:	Atmosphere Explorer
Description:	1,000-pound spacecraft to be launched by Delta rocket into elliptical Earth orbit to make scientific studies of solar ultraviolet radiation in the Earth's atmosphere. It will investigate the chemical processes and energy transfer mechanisms which control the structure and behavior of the Earth's atmosphere and ionosphere through the region of high solar energy absorption. An onboard propulsion system will permit the spacecraft to make changes in its orbit while investigating in detail the regions between 75 and 95 miles above Earth.
Schedule:	Three spacecraft to be launched from WTR in 1973, 1974 and 1975. Two previous launches, Explorer 17 in April 1963 and Explorer 32, May 1966.
Program Officials:	F. Gaetano, Program Manager; D. Grimes, GSFC, Project Manager
Funding:	$7.1 million obligated through June 1970; runout costs estimated at $43-49 million.
Contractor:	Not yet selected.

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Program:	Earth Resources Technology Satellite (ERTS)
Description:	Polar orbiting, 575 miles, series of spacecraft for the purpose of conducting a variety of experiments in Earth resources disciplines including agriculture, oceanography, forestry, cartography, etc., and to develop a ground data handling system. The first two spacecraft will obtain a large volume of Earth surface imagery, including visual and infrared, over a period of several seasons to verify their Earth resources capability. Results will be used to make a decision on whether or not to proceed to an operational system. Delta launch vehicle from WTR.
Schedule:	ERTS-A to be launched in 1972 and ERTS-B in 1973.
Program Officials:	T. E. George, Program Manager; W. E. Scull, GSFC, Project Manager.
Funding:	$14.2 million obligated through June 1970; runout costs estimated at $140-200 million.
Contractor:	General Electric Co.

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Program:	Geodetic Earth Orbiting Satellite (GEOS)
Description:	Earth orbiting geodetic satellites designed to establish one world datum, improve positional accuracies of control stations and tracking sites and to better define structures of Earth's gravitation field and apply geodetic satellite techniques to solid Earth geophysics and oceanography. Develop an Earth reference system by the precise location of approximately 86 widely separated control points on the surface of the earth to an accuracy of ± 10 meters and interconnect areas into a unified Earth-centered reference system.
Schedule:	Geodetic satellites launched November 1965 (GEOS I) June 1966 (PAGEOS I), January 1968 (GEOS II) GEOS C scheduled for launch 1972 from WTR by a Delta launch vehicle.
Program Officials:	J. D. Rosenberg, Program Manager; R. Rados, GSFC, Project Manager.
Funding:	$18.6 obligated thru June 1970; estimated runout costs of program $29-31 million.
Contractor:	Applied Physics Laboratory

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Program:	Improved TIROS Operational Satellite (ITOS)
Description:	A series of polar orbiting operational meteorological satellites based on TIROS research and development experience. In response to the requirements of ESSA for day-night capability in a single spacecraft, ITOS employs essentially flight proven sensors and stabilization in all three axes. The primary sensor complement consists of two AVCS and two APT camera systems for day and night cloud cover photos and two scanning radiometers (SR). Delta launch vehicle from WTR.
Schedule:	First spacecraft, TIROS-M, NASA R&D satellite, launched in January 1970 and later turned over to Environmental Science Services Administration. First in a series of ESSA-funded satellites to be launched in late 1970 or early 1971. Nine NASA-funded TIROS spacecraft have been launched, not including TIROS 10 funded by ESSA. TIROS 1 through 8 were spin-stabilized and space-oriented containing two vidicon camera systems and, in some cases, infrared radiometers; TIROS 9 was in a "cartwheel" configuration carrying two wide-angle vidicon camera systems.
Program Officials:	M. Garbacz, Program Manager, and W. Jones, GSFC, Project Manager
Funding:	Operational system to be funded by ESSA. TIROS-M costs estimated at about $19 million for NASA.
Contractor:	RCA Corp.

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Program:	Interplanetary Monitoring Platform (IMP)
Description:	The IMP program consists of a series of spacecraft designed to extend our knowledge of solar, lunar, terrestrial relationships by conducting a continuing study of the radiation environment of the interplanetary medium. They perform detailed and near continuous studies of the interplanetary environment for orbital periods comparable to several rotations of active solar regions; study particle and field interactions; investigate, during a period of decreasing solar activity, through several solar rotations, the nature and features of the solar wind, the interplanetary fields and cosmic rays. Spacecraft are launched by a Delta from ETR into highly elliptical Earth orbit, except for one lunar anchored IMP.
Schedule:	IMPS, I, H and J are scheduled for launch in late 1970, 1972 and 1973. Previous launches were made in November 1963, October 1964 (vehicle failure), May 1965, July 1966, May 1967, July 1967, June 1969.
Program Officials:	F. Gaetano, Program Manager, P. Butler (GSFC), Project Manager
Funding:	$51.3 million obligated through June 1970; total runout costs estimated at $70-75 million.
Contractor:	GSFC

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Program:	Mariner Mars 1971
Description:	Interplanetary spacecraft to study Mars for a period of time sufficient to observe 70% of planet's surface and identify potential landing sites for Viking as well as seasonal changes and provide broad area TV observations of the planet from Martian orbit. In addition to photos of planet's surface the spacecraft will obtain data on Martian atmosphere and surface. Atlas/Centaur launch vehicle from ETR.
Schedule:	Two spacecraft to be launched in May about ten days apart in 1971 to arrive at Mars in November, which is early summer in the southern hemisphere, for viewing the surface from low altitude of about 1,000 miles.
Program Officials:	E. W. Glahn, Program Manager, Project Manager, D. Schneiderman, JPL
Funding:	$79 million obligated through June 1970; runout costs estimated at $120-125 million.
Contractor:	Jet Propulsion Laboratory

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Program:	Mariner Venus/Mercury 1973
Description:	A 900-pound, modified Mariner Mars 1969 spacecraft, carrying television and scientific instrumentation will flyby Venus with a gravity assist on to Mercury to conduct exploratory investigations of both planets including measurements of environment, atmosphere, surface, and planetary characteristics. Two television cameras similar to those flown on the Mariner Mars 1969 and to be flown on the Mariner Mars 1971 missions but fitted with 1,500-mm Cassegrain telescopes. These will produce pictures of Venus and Mercury. The photographs of Venus are expected to show the planet's dense cloud blanket as well as ultraviolet "clouds," invisible to optical telescopes, which appear to circulate around the planet every five days. The pictures of Mercury will have a resolution similar to that of pictures of the Moon taken through Earth-based telescopes. Now only gross shading characteristics can be distinguished on Mercury with Earth telescopes. Mercury photography will be used to map and identify major physical landmarks of the planet, investigate its craters, determine the orientation of the spin axis, and establish a cartographic coordination system for Mercury. The photo team will also search the pictures for satellites of both planets.
Schedule:	The single spacecraft will be launched in the fall of 1973, swinging within 3,300 miles of Venus in February 1974, continuing on to fly within 625 miles of Mercury in March 1974.
Program Officials:	N. W. Cunningham, Program Manager; W. E. Giberson, JPL, Project Manager
Funding:	$900,000 obligated through June 1970; runout costs estimated at $95-120 million
Contractor:	Jet Propulsion Laboratory

Program:	Nimbus
Description:	Develop and flight test advanced sensors and technology basic to the study of the atmosphere and provide data for meteorological research. The Nimbus program consists of seven flight missions utilizing the same basic spacecraft, but incorporating system improvements and new and improved sensors. These flights are launched into polar orbit from the Western Test Range. The spacecraft is stabilized in three axes and points at the Earth at all times. The orbit of the satellite enables it to provide daily global coverage with TV visual and infrared photos. The spacecraft configuration allows for a sizeable number of relatively advanced observational sensors to be flown. Thor-Agena launch vehicle from WTR.
Schedule:	Four spacecraft launched. August 1964, May 1966 and April 1969, all successful, with a May 1968 failure of launch vehicle (Nimbus-B). Two more flights scheduled -- Nimbus-E in 1972, and Nimbus-F in 1973.
Program Officials:	Program Manager, B. B. Schardt, Project Manager, H. Press, GSFC.
Funding:	$247 million obligated through June 1970; total runout costs estimated at about $315-325 million.
Contractor:	GSFC (prime), General Electric (integration and test)

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Program:	Orbiting Astronomical Observatory (OAO)
Description:	Complex, almost 5000-pound spacecraft launched by Atlas-Centaur from ETR into about 400-mile circular Earth orbit to investigate stellar phenomena, galactic and intergalactic medium. The spacecraft provides power, thermal control, and precision pointing for the observatory systems. The spacecraft is capable of providing data storage, handling, transmission and reception, and is supported by a ground system. Astronomical instruments are capable of observing the electromagnetic spectrum (ultraviolet, X-ray, and gamma ray) from space. They measure the emission of diffuse nebulae, map the form and brightness characteristics of faint nebulae, record the brightness of hot stars, obtain absolute spectrophotometry data, observe the spectra of interstellar gas and dust, and observe X-ray emissions and their absorption in interstellar space.
Schedule:	OAO-B to be launched in fall of 1970 and C in 1971. Previous launches were in April 1966 (spacecraft failure) and December 1968.
Program Officials:	C. D. Ashworth, Program Manager, J. Purcell, GSFC, Project Manager
Funding:	$310 million obligated, runout $355-360 million.
Contractor:	Grumman Aircraft

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Program:	Orbiting Geophysical Observatory (OGO)
Description:	Earth orbit spacecraft, more than 1,000 pounds, to study the nature and variability of the Earth's near space environment. A standard, stabilized observatory-type spacecraft consisting of a basic structure and subsystem design was developed to be used repeatedly to carry large numbers of easily integrated scientific experiments in a wide variety of orbits for a period of at least a year. The experiments are primarily aimed toward obtaining a better understanding of Earth-Sun relationships and the Earth as a planet. THORAD/ Agena launch vehicle from ETR.
Schedule:	First OGO in September 1964 (spacecraft failure), October 1964 (spacecraft failure), June 1966, July 1966, March 1968, June 1969.
Program Officials:	F. Gaetano (Acting) & E. P. Merchanti (GSFC)
Funding:	$225 million obligated thru June 1970, estimated runout cost $240 million.
Contractor:	TRW Systems

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Program:	Orbiting Solar Observatory (OSO)
Description:	Earth orbiting spacecraft designed to obtain high resolution data from the Sun. Experiments in solar physics above the Earth's atmosphere, utilizing a standardized spacecraft which accommodates a variety of scientific instruments, in order to better observe and thus to better understand solar phenomena. Primary investigation selections are made on the basis of experiments which detect and measure electromagnetic radiations from the Sun that are not available from ground-based observations. Delta launch vehicle from ETR.
Schedule:	OSO's H and I scheduled for 1971 and 1973, with J & K 1974 and 1976. Previous spacecraft launched in March 1962, February 1965, August 1965 (vehicle failure), March 1967, October 1967, January 1969 and August 1969.
Program Officials:	C. D. Ashworth, Program Manager; J. M. Thole, Project Manager.
Funding:	One hundred million obligated thru June 1970; runout cost estimated at $175-185 million.
Contractor:	Ball Brothers Research Corp.

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Program:	Pioneer F & G
Description:	Two 550-pound spacecraft adopted from preceding Pioneers, to make exploratory investigations beyond the orbit of Mars of the interplanetary medium, the nature of the asteroid belt and the environmental and atmospheric characteristics of the planet Jupiter. Each spacecraft will be capable of performing 13 scientific experiments in space including photographing Jupiter. Radioisotope Thermoelectric Generators (RTG) will be used as the primary source of spacecraft electrical power. Atlas-Centaur launch vehicle from ETR.
Schedule:	The two spacecraft will be launched in 1972 and 1973 on missions which will last about two years each. After a trip of more than half a billion miles to Jupiter, each spacecraft will spend about a week swinging around the planet with a period of closest approach and maximum scientific interest about 100 hours. 100,000 miles closest approach of the planet. Pioneers 6,7,8, and 9 were placed in solar orbit in 1965, 66, 67, and 68 respectively.
Program Officials:	R. Kraemer (Acting) Program Manager; Project Manager, C. F. Hall (Ames).
Funding:	$24.5 million obligated through June 1970; runout costs estimated at $90-105 million.
Contractor:	TRW Systems

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Program:	Radio Astronomy Explorer (RAE)
Description:	Gravity-gradient stabilized satellite with 750 foot extendable antennas designed to monitor low frequency radio signals in the Milky-Way, other galaxies the Sun, Jupiter and the Earth's environment. Also with next launch, RAE-B, measurements will be made at lunar distances of galactic and solar radio noise external to terrestrial background interference. Delta launch vehicle.
Schedule:	First spacecraft launched into Earth orbit July 1968 the next one scheduled for launch into lunar orbit, 1972 from WTR.
Program Officials:	F. W. Gaetano, Program Manager; J. T. Shea, GSFC, Project Manager
Funding:	$15.5 million obligated thru June 1970; runout costs estimated at $20-22 million.
Contractor:	Goddard Space Flight Center

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Program:	Small Astronomy Satellite (SAS)
Description:	Earth orbiting 320-pound spacecraft which will survey space in search for X-ray, gamma-ray and ultra-violet sources inside and outside of our galaxy. Other spectral regions will be systematically scanned and a catalog of celestial X-ray sources will be developed. Launch vehicle Scout.
Schedule:	First of two spacecraft to be launched, December 1970 from San Marco platform off the coast of Kenya; second to be launched in 1971.
Program Officials:	J. R. Holtz, Program Manager; M. Townsend, GSFC, Project Manager
Funding:	$16.7 million obligated thru June 1970; runout cost estimated at $33-37 million.
Contractor:	Goddard Space Flight Center

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Program:	Small Scientific Satellite
Description:	Earth orbiting spacecraft to investigate magnetic fields, auroral phenomena and charged particles. This includes the development of main-phase magnetic storms; the relation between magnetic storms, aurora, and the acceleration of particles within the inner magnetosphere. Scout launch vehicle.
Schedule:	Launch in 1971 from San Marco platform, Kenya
Program Officials:	J. R. Holtz, Program Manager; G. W. Longanecker, GSFC, Project Manager
Funding:	$5.4 million obligated thru June 1970; estimated total cost about $7 million
Contractor:	Not Chosen

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Program:	Synchronous Meteorological Satellite (SMS)
Description:	A synchronous (stationary) orbit satellite designed to meet the National Operational Meteorological Satellite System (NOMSS) requirements as specified by ESSA for continuous observation of the atmosphere on an operational basis. The spacecraft design provides for a day and night cloud cover viewing capability for the collection and dissemination of meteorological data plus the provision to carry additional sensors to be negotiated between ESSA and NASA. Delta launch vehicle from ETR.
Schedule:	NASA to fund and launch first two spacecraft scheduled for 1972 and 1973.
Program Officials:	Program Manager, M. Garbacz; Project Manager, D. Fordyce (GSFC).
Funding:	$2.2 million obligated through June 1970; runout costs estimated at $20-30 million.
Contractor:	Philco-Ford Corp.

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Program:	Viking
Description:	Unmanned Martian orbiter/lander. Weight of the orbiter 5,300 pounds, lander 2,300. A Titan/Centaur launch vehicle will place the spacecraft on a trajectory to Mars, where the orbiter capsule will be placed in orbit around the planet and the sterilized lander will enter the Martian atmosphere to soft-land via parachute and retrorocket on the surface. Its power source will be radioisotope thermoelectric generators. The TV carrying spacecraft will transmit photographs from the surface of the planet and from orbit. Particular emphasis will be placed on obtaining biological, chemical and environmental factors which might indicate the existence of life on the planet.
Schedule:	Two spacecraft will be launched from ETR in 1975. Viking is a follow-on to the 1964-65, 1969 and the 1971 Mariner flights to Mars.
Program Officials:	W. Jakobowski, Program Manager; J. Martin (LaRC), Project Manager
Funding:	$43.8 million obligated through June 1970; runout costs estimated at $700-850 million.
Contractor:	Martin Marietta Corp., Lander Capsule Jet Propulsion Laboratory, Orbiter

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